

REMARKSRegarding the Status of the Claims:

Claims 1, 5-8, 10, 13, 14 and 16-23 are pending.

Claims 18 – 23 have been withdrawn from consideration. However, these method claims depend from Claim 1 so rejoinder is requested if Claim 1 is allowed.

Regarding the Claim Amendments presented in this reply:

The amendments to the claims do not add new matter.

Claim 1 is amended to recite each lance extends through the roof, as supported by claim 3. Positioning the lances to enter the vessel through the roof portion ensures enough space between the lances and the sidewall of the vessel for the feed chutes 12.

Claim 1 is amended to recite each lance has a discharge end in the interior of the vessel directed for discharging the oxygen containing gas downwardly into the interior of the vessel and downwardly entraining post combusted gases, as supported by page 3, lines 14-15.

Claim 1 is amended to recite each feed chute projects through the roof of the metallurgical vessel, as supported by claim 10.

Claim 1 is amended to recite each chute discharge end is at an elevation above an elevation of the corresponding lance discharge end, as supported by FIG. 1.

Claim 1 is amended to recite the lance discharge end not extending into a region of the vessel interior below the center opening, as supported by FIG. 1.

Claim 10 is amended to recite a melting cyclone extending from the roof center opening, as supported at page 7, lines 35-36.

Claim 10 is amended to recite the lances positioned to avoid contact with molten material passing downwards from the melting cyclone to the metallurgical vessel, as supported by page 5, lines 20-23; see also molten iron 14 dropping from the melting cyclone 2 in FIG. 1.

Claims 13 and 15 were combined.

Regarding the Advisory Action:

The following rejections were maintained:

- I. Claims 1, 5 - 8, 10, 16 and 17 under 35 U.S.C §103(a) over US 5,662,860 to Klaassen et al. (hereinafter, “Klaassen”) and US 5,769,9823 to Nishikawa et al. (hereinafter, “Nishikawa”); and
- II. Claims 13 – 15 under 35 U.S.C §103(a) over Klaassen, Nishikawa, and US 5,733,358 to Geiger et al. (hereinafter, “Geiger”).

Regarding Rejection I:

The Advisory Action states Applicant has not submitted factual evidence to support the argument that the position of chute 22 of Klaassen is not a functional equivalent of the position of the chute in the presently claimed metallurgical vessel.

Klaassen shows coal being supplied by means of chute 22, which is not positioned between a lance and the sidewall of the metallurgical vessel in a radial direction.

Klaassen positions the coal feed chute 22 to downwardly feed coal into the substantially upward flow of the post-combusted gas. Also, the feed chute discharge opening is at a completely different location than in the present invention. Klaassen locates the discharge opening of coal feed chute 22 above the lances and in the central region of the metallurgical vessel to feed and drop into the foam. As such, material fed to the vessel by means of the Klaassen chute 22 may be blown out of the vessel, because of the position of the chute 22 in the upward flow of gases.

Present Figures 3 and 4 illustrate simulations of the difference between the position of a chute according to the present invention, and the position of the chute according to Klaassen. As stated on page 8, lines 27 – 31 of the specification:

“Figure 2 shows a section of the vessel 1, a lance 3 projecting into the section of the vessel and the trajectories 15 of coal particles added to the vessel. The advantage obtained by adding coal particles a short distance from the lances is clear as the particles are entrained towards the slag layer with the substantially downward flow of post-combusted gases at the sidewall of the vessel.”

In contrast, as illustrated in Figure 4 and explained at page 8, lines 31 – 34 of the

present specification, when the chute is positioned between the lances, as in Klaassen, “the majority of the particles are entrained in the upwardly directed flow of post-combusted gases in the centre of the vessel and leave the vessel.”

Thus, the position of chute 22 is not a functional equivalent of the position of the chute in the presently claimed metallurgical vessel.

New Claim Features Further Distinguish Over Klaassen

Claim 1 is amended to recite the lance discharge end not extending into a region of the vessel interior below the center opening, as supported by FIG. 1. Klaassen does not disclose this. This feature is advantageous because post combustion gases are rising in the central portion and would conflict with the downwardly directed gas from the lances.

Claim 10 is amended to recite the lances positioned to avoid contact with molten material passing downwards from the melting cyclone to the metallurgical vessel. Klaassen does not disclose this. This feature is advantageous because the molten pre-reduced iron oxide 14 falling down from the melting cyclone 38 into the vessel 31 would damage the lances, as explained at page 5, lines 20-23; see also molten iron 14 dropping from the melting cyclone 2 in FIG. 1.

The metallurgical vessel according to Claim 6

Applicants had asserted Claim 6 further distinguishes over the references. Claim 6 recites the end portion of the lance configured to direct the oxygen containing gas towards the central axis of the metallurgical vessel under a second acute angle from the vertical which second acute angle is greater than the first acute angle.

In response to applicant's arguments for Claim 6, the Advisory Action asserted the metallurgical vessel of Klaassen would be capable of having a configuration where the end portion of the lance is configured to direct the oxygen containing gas towards the central axis of the vessel under a second acute angle from the vertical which is greater than the first acute angle since the orientation of the lance may have an orientation such as in Fig. 2 or a more vertical orientation.

Applicant submits Fig. 2 of Klaassen is the opposite of present Claim 6. The

second angle is more obtuse (less acute) relative to vertical. This is because Klaassen wants the final angle of discharge as close to vertical as possible. At Col. 2, lines 36 – 46, Klaassen explains the lances are oriented as much as possible vertically, thereby achieving the effect that the supply of oxygen to the metallurgical vessel still takes place as much as possible in the same place above the slag layer as the level of slag varies. Klaassen goes to the effort to modify its apparatus to increase the vertical orientation of its lances. Thus, if the first segment is already sufficiently vertical then Klaassen provides no motivation to make the second (discharge end) less vertical.

Moreover, the Claim 6 configuration helps keep the lances out of the central zone. The two part configuration at different angles, unexpectedly makes it possible to have the lances enter the vessel at the roof portion of the vessel and to direct the oxygen at the correct angle with respect to the vertical axis of the vessel, while at the same time keeping the lances out of the central part of the vessel. This is an important feature, because of the pre-reduced iron oxide 40 falling down from the melting cyclone 38 into the vessel 31. As explained at page 9, lines 33 – 37 of the specification,

[t]he reducing process gas rises and is further post-combusted in the melting cyclone 38 with oxygen containing gas supplied to the melting cyclone. Iron oxide supplied to the melting cyclone is pre-reduced approximately to FeO and at least partly melted in the melting cyclone. The pre-reduced iron oxide 40 then falls or flows down into the metallurgical vessel 31.

Positioning the lances to enter the vessel through the roof portion ensures enough space between the lances and the sidewall of the vessel for the feed chutes 12. In this position of the feed chute is located for feeding all particles to the slag and/or molten metal and to prevent the particles from entering the central flow of gases and being blown out directly.

The metallurgical vessel according to Claim 8

With regards to applicant's arguments for Claim 8, the Advisory action asserts the lances of the vessel of Klaassen would be capable of being adjustable in height. Applicant relies on its previously submitted arguments on this.

Regarding Rejection II:

Claim 13 has been amended to recite the tuyeres of Claim 15 comprising oxy-fuel burners.

Regarding Claims 13-15, the Advisory Action asserted the Examiner relied on Fig. 5 of Geiger that discloses that the vessel of Geiger comprises a burner (19) that can burn natural gas and a natural gas/oxygen burner 12, not tuyeres 17.

Applicant respectfully replies that if Geiger's tuyeres were not oxy-fuel burners then this indicates Geiger teaches not to use oxy-fuel burners for tuyers regardless of use of oxy-burners elsewhere in its device.

In Conclusion:

The present application is in condition for allowance. Applicants request favorable action in this matter. In order to facilitate the resolution of any issues or questions presented by this paper, the Examiner is welcome to contact the undersigned by phone to further the discussion.

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